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(54) **TIMPANI TUNING AND PITCH CONTROL SYSTEM**

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G10D 13/04 (2006.01)

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CPC ***G10H 1/44*** (2013.01); ***G10D 13/04*** (2013.01); ***G10G 7/02*** (2013.01)

(58) **Field of Classification Search**
USPC 84/419, 454
IPC G10H 1/44
See application file for complete search history.

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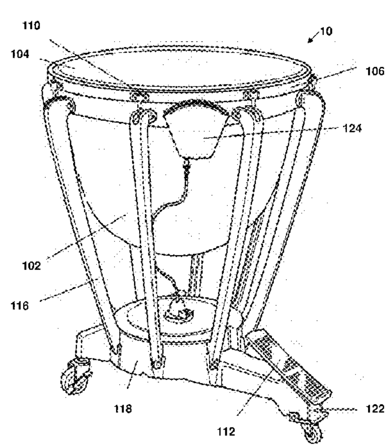
(57) **ABSTRACT**

Provided are a percussion instrument tuning system and method. A position sensor determines at least one first position of a tuning mechanism of a timpano. A control unit generates a calibration result by measuring a first pitch of the timpano corresponding to the at least one first position of the tuning mechanism and estimates a second pitch of the timpano corresponding to at least one second position of the tuning mechanism from the calibration result.

15 Claims, 10 Drawing Sheets



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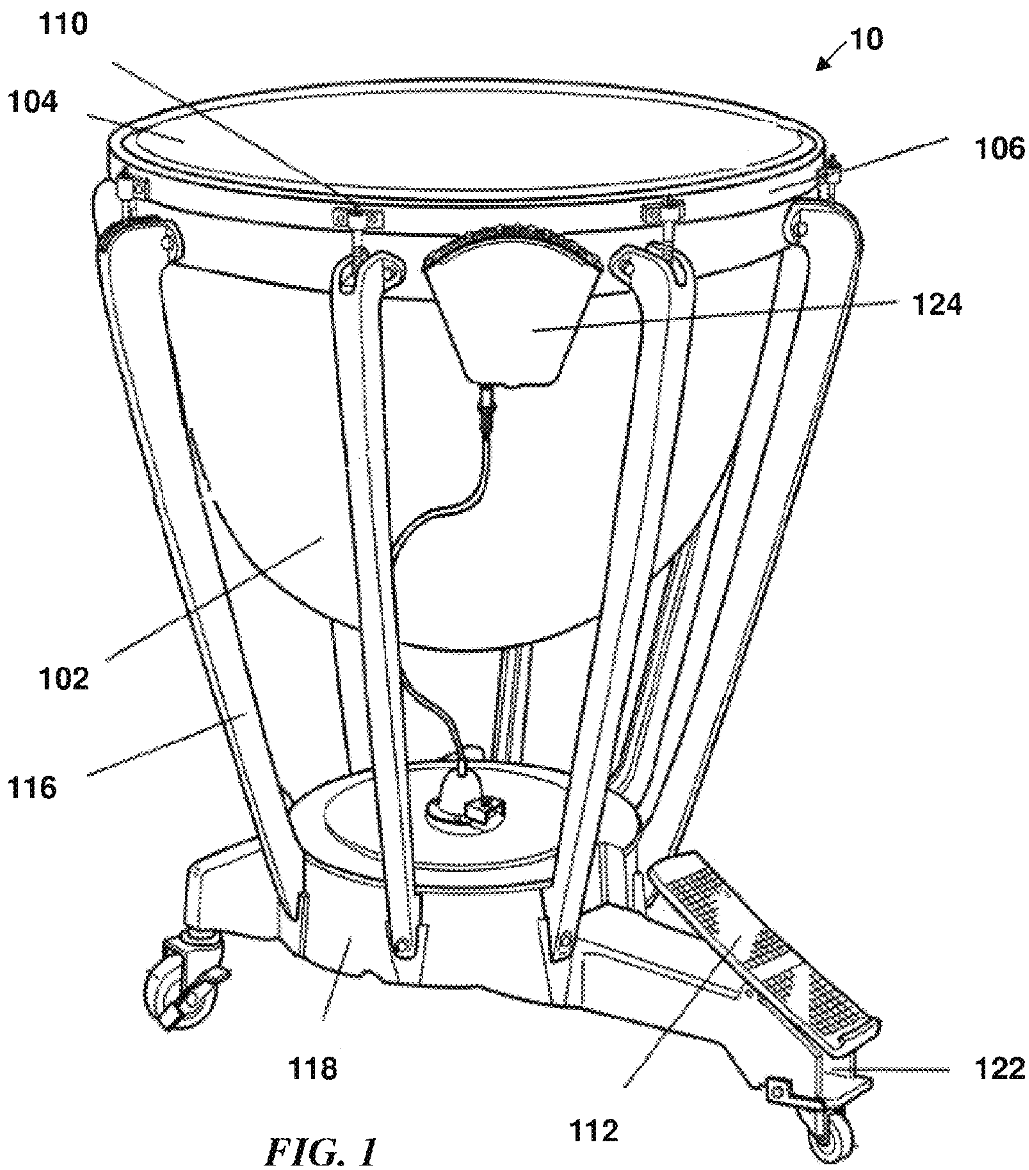

FIG. 1

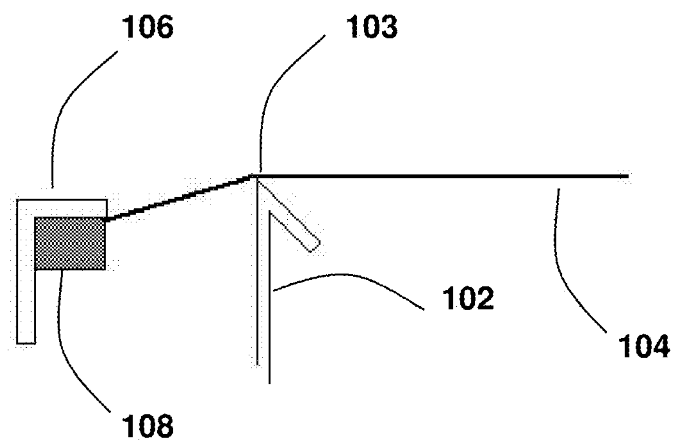

FIG. 2

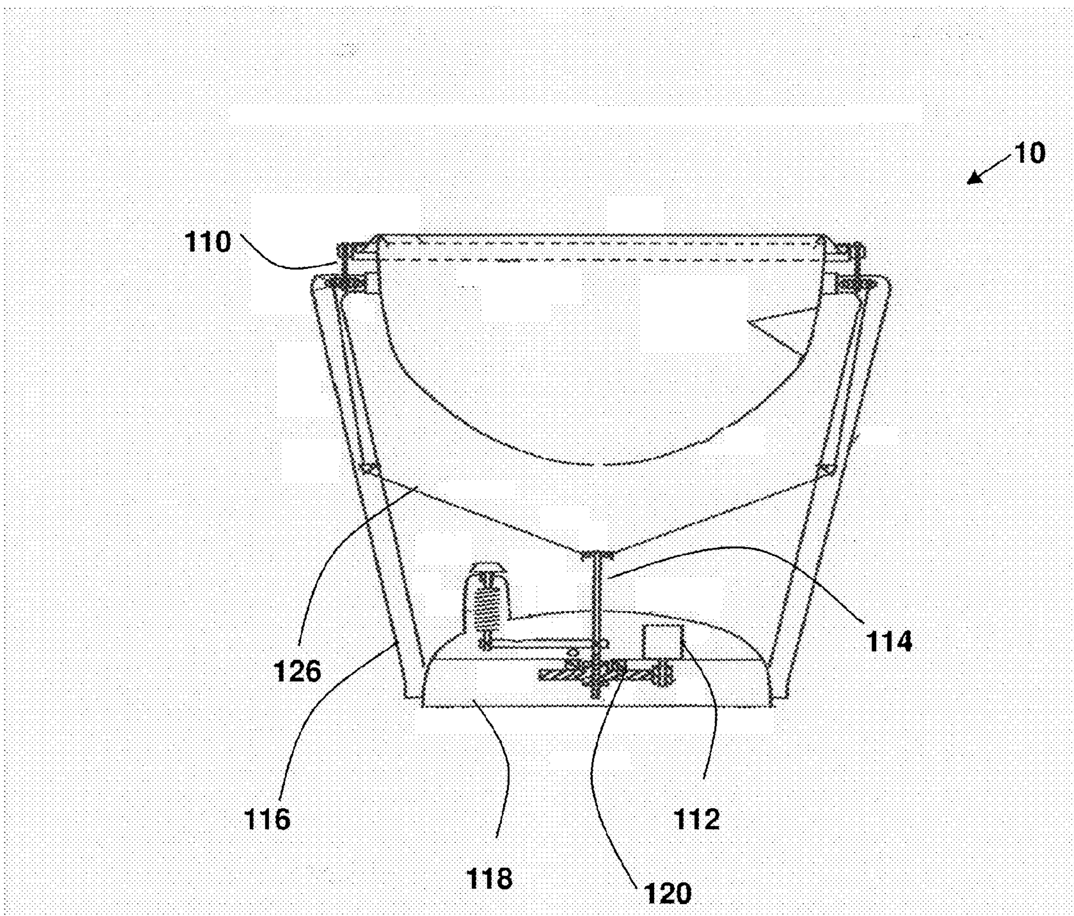

FIG. 3

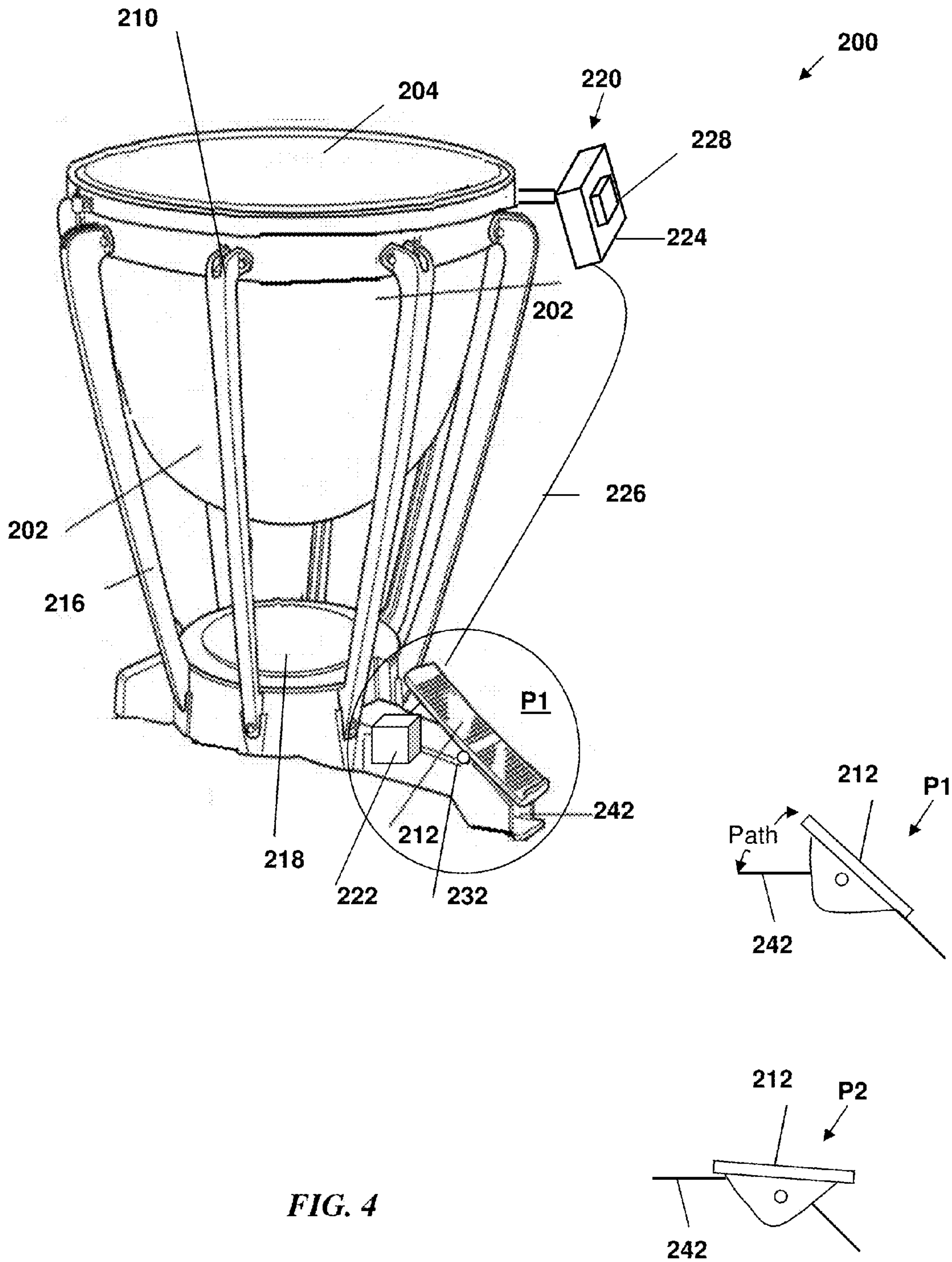
210
204
220
200
228
224
202
226
202
216
218
P1
212
242
222
232
212
P1
Path
242
212
P2
242

FIG. 4

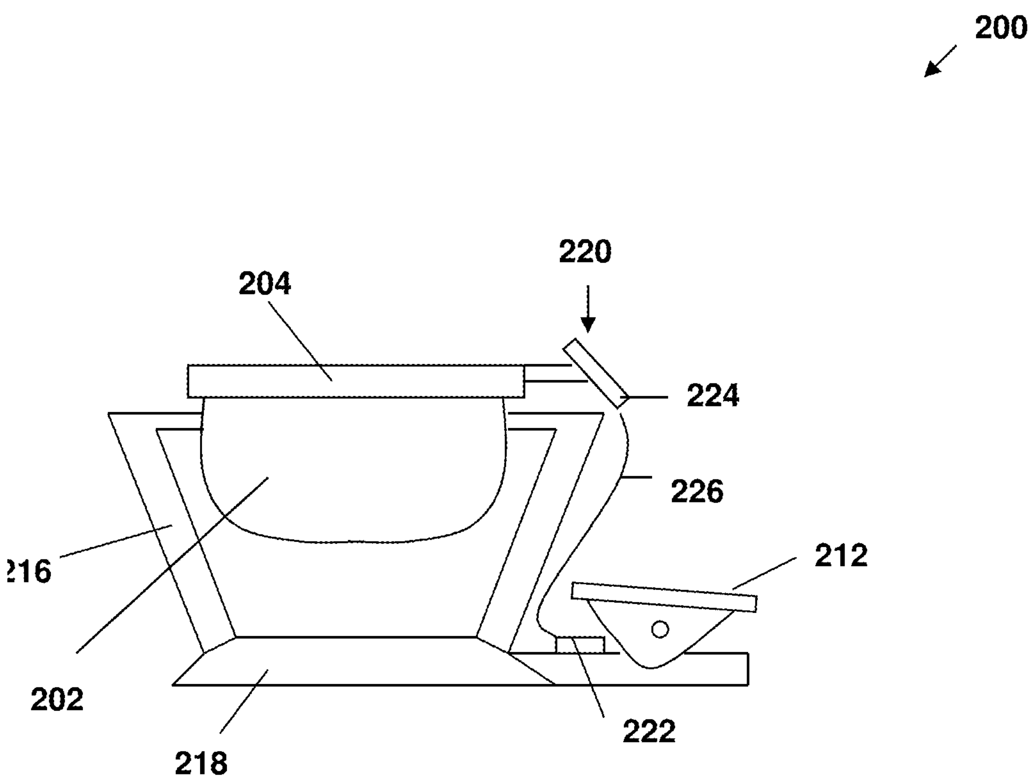

FIG. 5

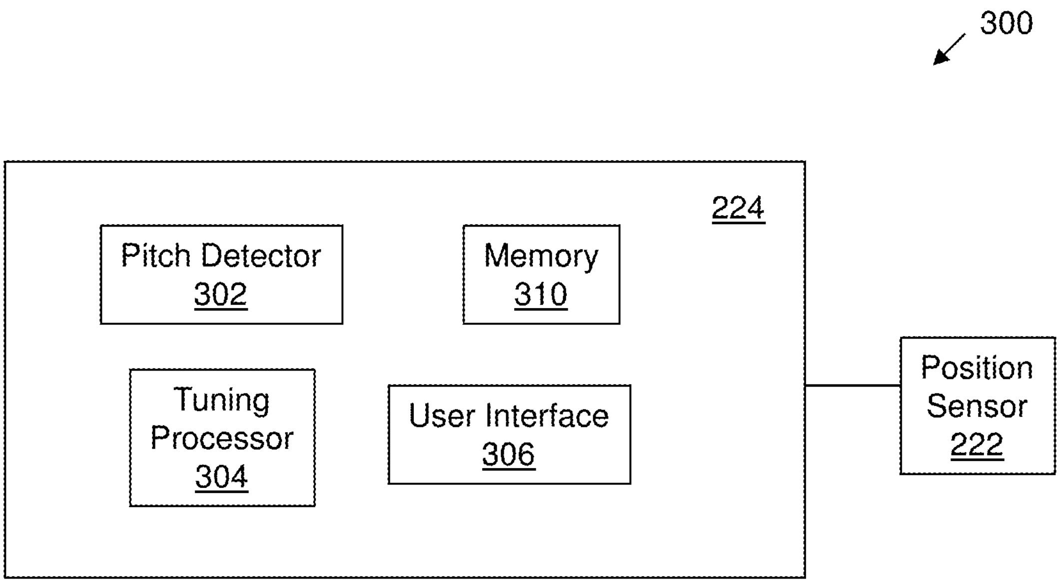
300
224
Pitch Detector
302
Memory
310
Tuning
Processor
304
User Interface
306
Position
Sensor
222

FIG. 6

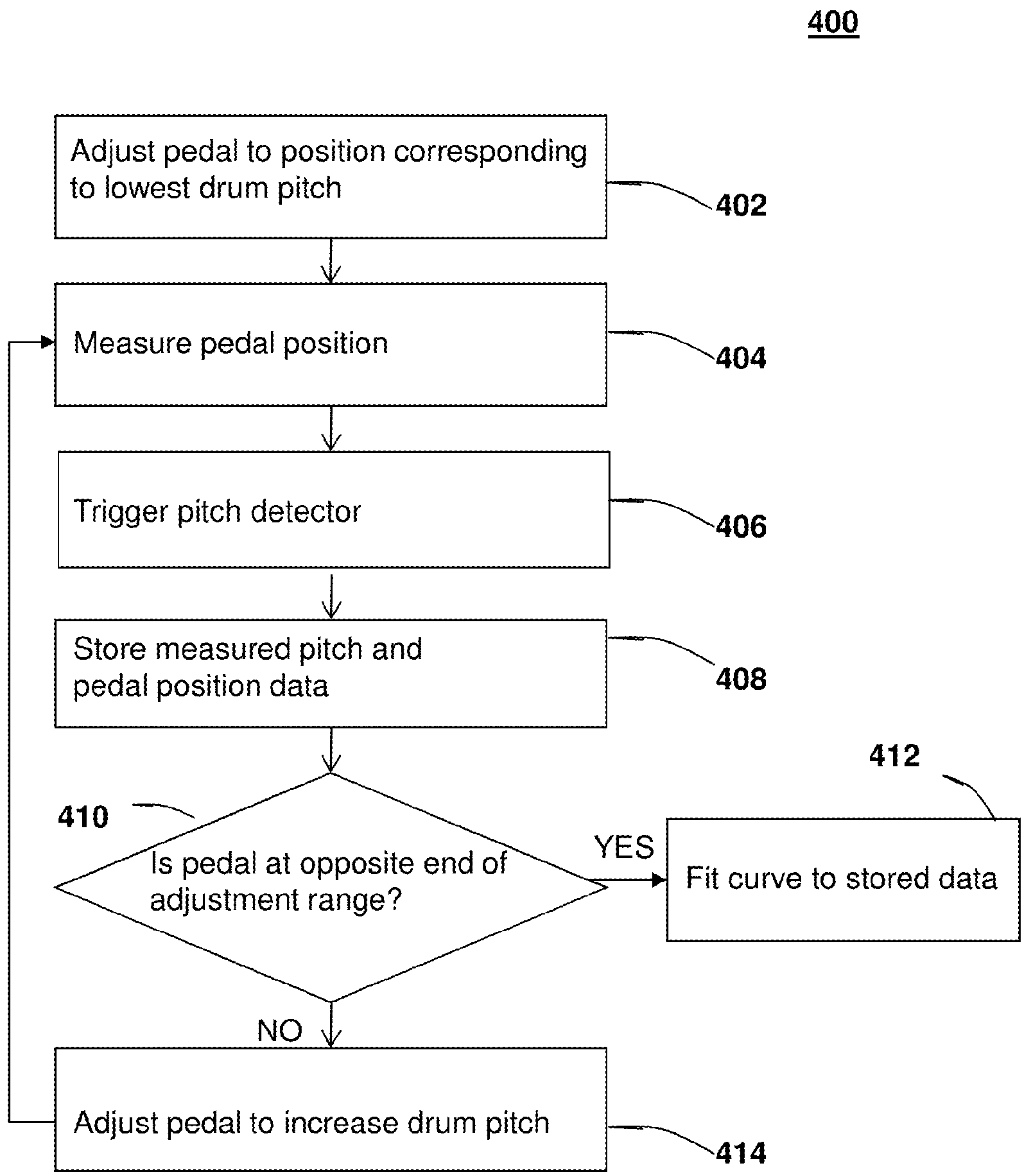
400
Adjust pedal to position corresponding to lowest drum pitch
402
Measure pedal position
404
Trigger pitch detector
406
Store measured pitch and pedal position data
408
410
Is pedal at opposite end of adjustment range?
YES
Fit curve to stored data
412
NO
Adjust pedal to increase drum pitch
414

FIG. 7

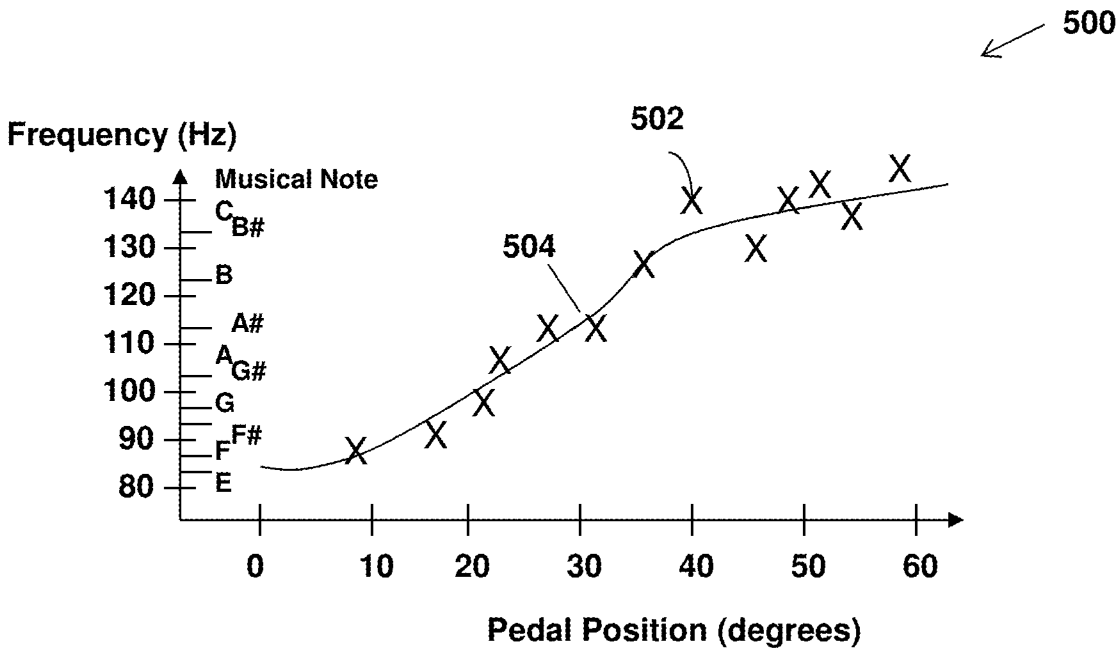
500
502
504
Frequency (Hz)
Musical Note
140
130
120
110
100
90
80
C
B#
B
A#
A
G#
G
F#
F
E
0
10
20
30
40
50
60
Pedal Position (degrees)

FIG. 8

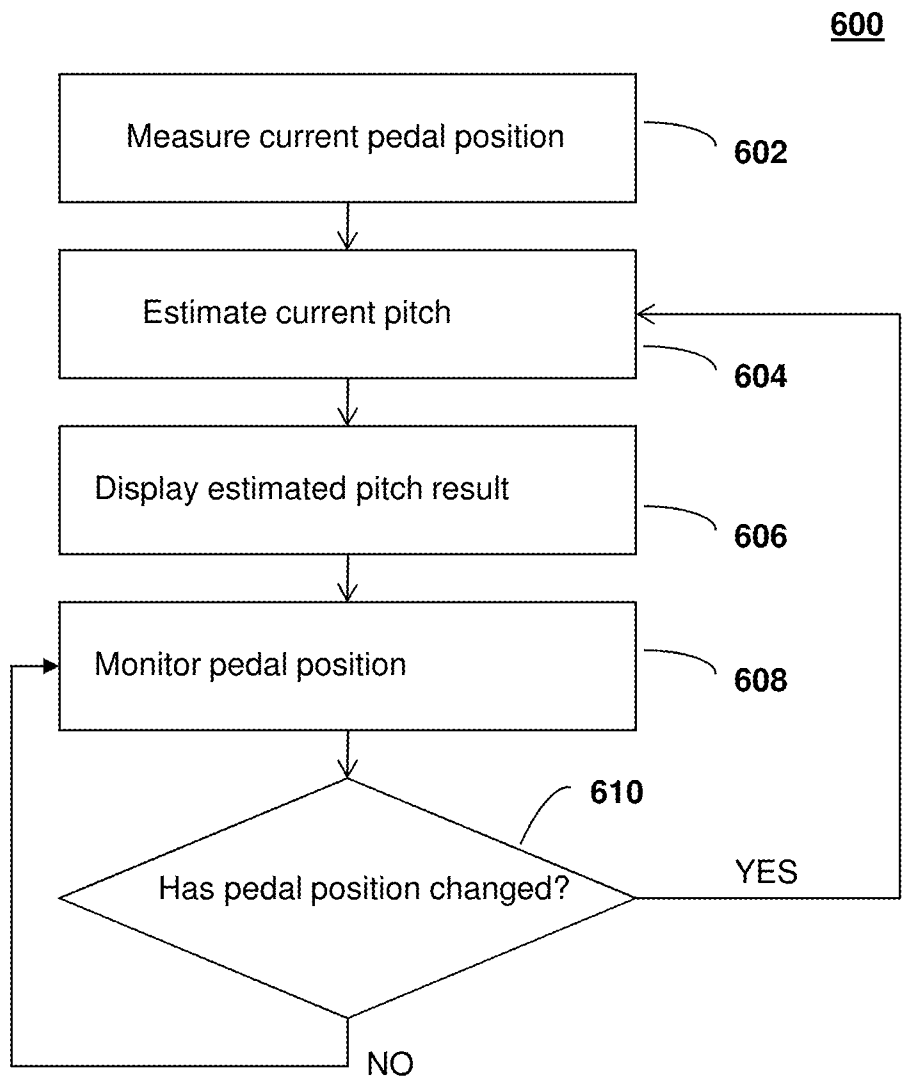
600
Measure current pedal position
602
Estimate current pitch
604
Display estimated pitch result
606
Monitor pedal position
608
610
Has pedal position changed?
YES
NO

FIG. 9

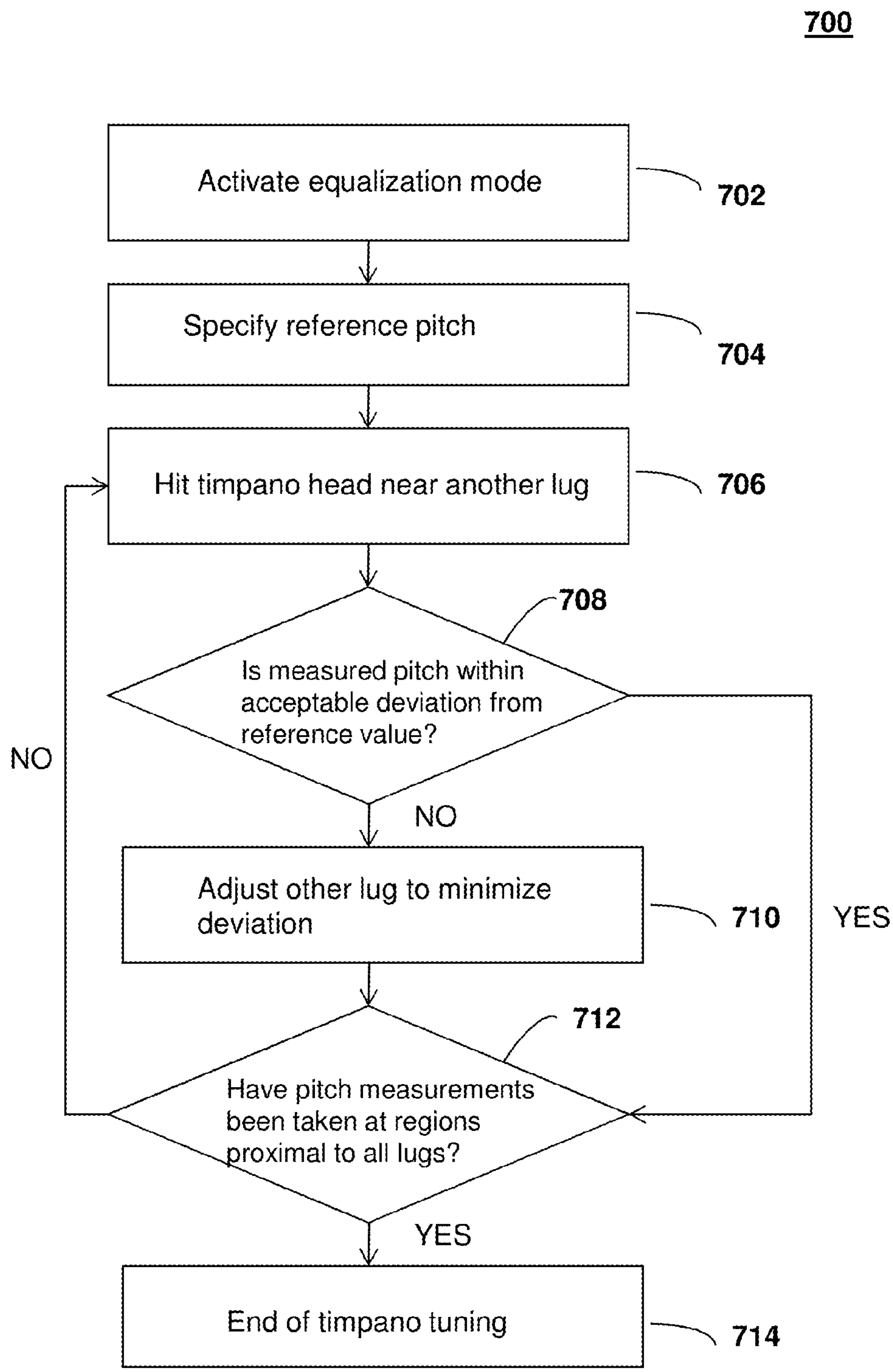
700
Activate equalization mode
702
Specify reference pitch
704
Hit timpano head near another lug
706
708
Is measured pitch within acceptable deviation from reference value?
NO
NO
YES
Adjust other lug to minimize deviation
710
712
Have pitch measurements been taken at regions proximal to all lugs?
YES
End of timpano tuning
714

FIG. 10

TIMPANI TUNING AND PITCH CONTROL SYSTEM

RELATED APPLICATIONS

This application claims the benefit of U.S. Patent Application No. 61/699,559 filed Sep. 11, 2012, the entirety of which is incorporated by reference herein.

This application is related to U.S. patent application Ser. No. 13/004,166, filed Jan. 11, 2011, entitled "Drum and Drum-Set Tuner", and published as U.S. Patent Application Publication No. 2011/0179939, U.S. patent application Ser. No. 13/688,822 filed Nov. 29, 2012, and U.S. patent application Ser. No. 13/886,342 filed May 3, 2013, the entirety of each of which is incorporated by reference herein.

FIELD OF THE INVENTION

The present inventive concepts relate generally to single-headed percussion instruments, and more specifically, to tuning and pitch control systems and methods for timpani or related drums.

BACKGROUND

Timpani are well-known musical instruments, more specifically, single-headed drums used in orchestras, marching bands, or other musical ensembles.

Timpani are typically tuned by using individual pedals to adjust the tension of the drum head, which in turn, changes the pitch of the drum.

SUMMARY

In one aspect, provided is a percussion instrument tuning system, comprising: a position sensor that determines at least one first position of a tuning mechanism of a timpano; and a control unit that generates a calibration result by measuring a first pitch of the timpano corresponding to the at least one first position of the tuning mechanism, and that estimates a second pitch of the timpano corresponding to at least one second position of the tuning mechanism from the calibration result.

In another aspect, provided is a method for tuning a timpano, comprising: determining at least one first pedal position of a timpano; generating a calibration result by measuring a first pitch of the timpano corresponding to the at least one first position of the pedal; and estimating a second pitch of the timpano corresponding to at least one second position of the tuning mechanism from the calibration result.

In another aspect, provided is a method for method for tuning a timpano, comprising: specifying a reference value corresponding to a desired timpano pitch; applying a force at a timpano head location; determining a deviation between a measured pitch value in response to the force applied at the timpano head location and the reference value; and adjusting the timpano at the timpano head location in response to a determination that the deviation is greater than a threshold value.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and further advantages of this invention may be better understood by referring to the following description in conjunction with the accompanying drawings, in which like numerals indicate like structural elements and features in the various figures. For clarity, not every element may be labeled

in every figure. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

FIG. **1** is a perspective view of a timpano having a conventional tuning gauge.

FIG. **2** is a close-up side view of a drum-head mounting and tensioning system of the timpano of FIG. **1**.

FIG. **3** is a cross-sectional front view of a timpano, in accordance with an embodiment.

FIG. **4** is a perspective view of a timpano, in accordance with an embodiment.

FIG. **5** is a side view of the timpano of FIG. **4**.

FIG. **6** is a block diagram of a timpani tuning system, in accordance with an embodiment.

FIG. **7** is a flow diagram of a method for tuning a timpano, in accordance with an embodiment;

FIG. **8** is a graph of a calibration curve generated according to the method of FIG. **7**, in accordance with an embodiment;

FIG. **9** is a flow diagram of a method for tuning a timpano, in accordance with an embodiment;

FIG. **10** is a flow diagram of a method for tuning a timpano, in accordance with an embodiment.

DETAILED DESCRIPTION

Reference in the specification to "one embodiment" or "an embodiment" means that a particular, feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the teaching. References to a particular embodiment within the specification do not necessarily all refer to the same embodiment.

The present teaching will now be described in more detail with reference to exemplary embodiments thereof as shown in the accompanying drawings. While the present teaching is described in conjunction with various embodiments and examples, it is not intended that the present teaching be limited to such embodiments. On the contrary, the present teaching encompasses various alternatives, modifications and equivalents, as will be appreciated by those of skill in the art. Those of ordinary skill having access to the teaching herein will recognize additional implementations, modifications and embodiments, as well as other fields of use, which are within the scope of the present disclosure as described herein.

In brief overview, provided is an electronic tuning system that incorporates pitch measurement functionality for significantly improved accuracy and ease of use. This tuning system directly measures the drum's pitch, thus eliminating the need to estimate the pitch by ear. The electronic timpani tuner includes a simple calibration procedure that enables a note pitch to be set with improved accuracy. In particular, the tuning system can generate calibration data by measuring a pitch at a timpano corresponding to each of one or more positions of the timpano tuning pedal or other tuning mechanism. The calibration data can be used to estimate subsequent pitch values for each of a plurality of different timpano pedal positions. The estimated pitch values and/or actual measured pitch values can be displayed, depending on whether the system is configured for a calibration mode or a performance mode. The display of estimated pitch values in performance mode, for various pedal positions, provides the function of an electronic tuning gauge. Accordingly, the tuning system can be incorporated in new timpani designs or can be affixed to existing timpani, and is especially useful for existing timpani lacking tuning gauges.

The tuning system can enable the equalization of drum-head pitch adjacent to each tuning screw of the drum to improve overall drum tone, also known as clearing a drum-head. In some embodiments, the tuning system enables drumheads to be equalized with high precision and consequently improves the overall tone of a timpano.

FIG. **1** is a perspective view of a timpano **10** having a conventional tuning gauge **124**. FIG. **2** is a side view of a drum-head mounting and tensioning system of the timpano **10** shown in FIG. **1**. FIG. **3** is a cross-sectional view of a timpano **10**, in accordance with an embodiment.

The timpano **10** can include a bowl **102**, also referred to as a kettle or shell, with a head **104** stretched over a flesh hoop **108**, or a metal ring about a perimeter of the bowl **102**. The bowl **102** can be formed of copper, fiberglass, or other material known to those of ordinary skill in the art. The head **104** can be formed of gut, calfskin, plastic, or other stretchable material known to those of ordinary skill in the art. The head **104** can be held in place over the flesh hoop **108** at the bowl **102** by a counter hoop **106**, for example, at a lip of the bowl **102** or a bearing edge **103** as shown in FIG. **2**.

The counter hoop **106** is secured to the bowl **102** by a plurality of adjustable tension screws **110**, or tension rods and the like, which are coupled to the hoop **106** and positioned around the drum head **104**. In some embodiments, lugs or related receptacles are provided for holding a nut in place that a screw **110** can engage. The tension screws **110** can be used to secure and supply tension to the counter hoop **106**, which in turn can tighten or loosen the skin of the drum head **104**. Accordingly, a force applied by the tension rods **110** to the counter hoop **106** determines the tension of the drum head **104**. When the tension screws **110** are tightened, the drum head **104** is stretched, which can raise the pitch of the timpano **10**. When the tension screws **110** are loosened, the tension on the drum head **104** is reduced, which can lower the pitch of the timpano **10**. The timpano **10** includes a series of struts **116** that extend between the bowl **102** and a base **118**, and elevate the bowl **102** above the base **118**.

The timpano **10** includes a tuning pedal **112** located at the base **118** and is pivotally coupled to a pedal support **122** at the base **118**. The pedal **112** is directly or indirectly connected to the tension screws **110** via a plurality of cables or rods **126**, commonly referred to as a spider assembly, and can therefore control the applied force to thereby adjust the tension and hence pitch of the timpano **10** when the tuning pedal **112** is pivotally moved up and down. The tuning pedal **112** can be coupled to a clutch **120** or the like for controlling the pedal positions and to vary the tension and hence pitch of the drum head **104**. Other configurations for coupling can vary with the brand of timpani. Thus, when the pedal **112** is pressed down, a force is applied to tension cables **126** routed along the struts **116** which in turn communicate with the tension screws **110** to cause the drum head **104** to stretch, thereby increasing the pitch of the timpano **10**. Similarly, when the pedal **112** is released, the tension screws **110** cause the drum head **104** to relax, thereby decreasing the pitch of the timpano **10**.

The timpano **10** has a conventional mechanical tuning gauge **124** which provides a visual indication of the timpano's pitch based on either the pedal angle or counter hoop position. The tuning gauge **124** allows the timpanist to set the timpano **10** at the correct pitch before being sounded. The tuning gauge **124** can be controlled by the pedal **112**. The tuning gauge **124** is physically connected either to the counterhoop **106**, in which case the gauge **124** indicates how far the counterhoop **106** is pushed down by the pedal **112**. Alternative, the tuning gauge **124** can be connected to the pedal **112**, in which case the gauge **124** indicates the position of the pedal **112**.

A conventional gauge such as the gauge **124** shown at FIG. **1** is inaccurate and needs to be calibrated due to imprecision in the tuning mechanism and variation in pitch of the drum head **104** due to temperature, humidity, or stretching. To calibrate the gauge **124**, one must listen for the pitch of the drum and adjust the gauge **124** accordingly for each note. Calibrating the gauge **124** by ear, even with a pitch reference, introduces human error that can be significant, especially for less experienced musicians.

Many timpani fail to include such a gauge, requiring a percussionist to hit the drum in order to assess the pitch for each note or to provide estimates prior to striking the drum.

FIG. **4** is a perspective view of a timpano **200**, in accordance with an embodiment. FIG. **5** is a front view of the timpano **200** of FIG. **4**. The timpano **200** can eliminate human error and allow for simple, quick calibration.

The timpano **200** includes a bowl **202**, a head **204**, a set of struts **216**, a base **218**, and other components similar to those described in the conventional timpano **10** of FIGS. **1-3**. A detailed description of the similar or same components is not repeated due to brevity.

The timpano **200** incorporates a tuning system **220**, which includes a pedal position sensor **222** in communication with a control unit **224**. The timpani tuning system in accordance with embodiments of the present inventive concepts incorporates technology described in U.S. patent application Ser. No. 13/004,166, published as U.S. Patent Application Publication No. 2011/0179939 A1, entitled "Drum and Drum-Set Tuner," filed Jan. 11, 2011 by David Byrd Ribner, the contents of which are incorporated by reference herein in their entirety, which describes technology that enables an accurate measurement of a drum's pitch.

In an embodiment, the control unit **224** of the timpani tuning system **220** determines a pitch generated at the timpano **200**, thereby obviating the need to try to decipher the pitch by ear. The sensor **222** attached to the tuning pedal **212** can measure a position of the pedal **212**, for example, an angle of the pedal **212** relative to a surface a pedal support **242** at which the pedal **212** is movably, e.g., rotatably, coupled via a pivot point **232**. In an embodiment, an inclinometer based on a two or three axis accelerometer is provided for measuring the angle. Alternatively a rotary potentiometer can be implemented, or an optical angular sensor. The system **220** can include a connector **226** between the position sensor **222** and the control unit **224**. In one embodiment, the connector **226** is a wired cable, for example, shown in FIGS. **4** and **5**. In another embodiment, the connector **226** is a wireless link (not shown). The pitch information determined by the control unit **224** and the pedal position information determined by the sensor **222** are used to calibrate and equalize the timpano **200**, and to determine an estimated timpano pitch for each of one or more particular pedal positions. Any position sensor known to those of ordinary skill in the art can be implemented that measures the displacement or rotation of either the hoop or any other element of the tensioning linkage relative to some fixed reference

FIG. **6** is a block diagram of a timpani tuning system **300**, in accordance with an embodiment. The tuning system **300** can include a control unit **224** and a position sensor **222** similar to or the same as those described in FIGS. **4** and **5**.

The control unit **224** includes a pitch detector **302**, a tuning processor **304**, a user interface **306**, a memory **310**.

The pitch detector **302** can detect a signal corresponding to a pitch from the timpano head **204**. The pitch detector **302** can include a microphone or the like.

A mode selection switch, button, or the like can be part of the user interface **306** and can be used to place the tuning system **300** in at least one of a calibration mode, performance mode, or a equalization mode.

The calibration mode permits the tuning system **300** to be calibrated by measuring and recording the pitch and corresponding pedal position for a range of pedal positions determined by the user. A calibration curve or the like can be formed from the pedal position data and corresponding measured pitch data for tuning timpani with precision. A calibration clear input can be provided on the user interface **106** to enable the user to erase calibration data prior to performing a new calibration procedure. In addition, a calibration done input can be provided on the user interface **106** to enable the user to terminate collection of calibration data, for example after the pedal is at the opposite end of the adjustment range and a sufficient number of data samples have been acquired. The user interface **106** can also include a calibration store and recall input to enable the user store and recall calibration curves.

In the performance mode, also referred to as a normal mode, the tuning system **300** can generate and display an estimated pitch result from the calibration data.

In the equalization mode, pitch determinations near the tension screws **110**, or lugs or the like, around the perimeter of the drum information can be made, and can permit a user to adjust one or more tension screws **110** so that the pitches of the drum regions proximal the tension screws are the same or similar to each other and/or to a reference pitch against which each pitch measurement is compared. The reference pitch can be a specific musical note or frequency selected with the user interface. The reference pitch can also be a pitch measured from the timpano if so specified with the user interface. All readings can be matched to the user-specified note or frequency.

In the equalization mode, readings can be displayed so as to indicate the deviation from the reference pitch. The deviation can be displayed several ways: as a needle dial, a spinning disk, a numerical value in musical note units of cents or as a frequency in units of Hertz. After striking the timpano **200** near one of the tension screws **110**, the pitch associated with that tension screw **110** is displayed as the difference between the measurement and the reference pitch. This equalization mode display allows the timpanist to go around the drum from tension screw to tension screw and adjust each one for a reading close to zero and thereby equalize the drum by uniformly tuning it to the reference pitch

When the mode selection module **312** is set as a calibration mode, the pitch detector **302** can measure pitch data and the position sensor **222** can determine a corresponding pedal position for a range of pedal positions. This data can be stored at the memory **310**, for example, a computer readable storage medium. More specific examples (a non-exhaustive list) of the computer readable storage medium can include a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing.

The tuning processor **304** receives the calibration data, for example, from the memory **310** and/or from the pitch detector **302** and position sensor **222**, respectively, and can estimate a timpani pitch corresponding to a particular pedal position as determined by the pedal, hoop or linkage position sensor **222** in view of the calibration data. The tuning system **300** can apply standard regression or modeling techniques to fit the data to a curve so that the timpano pitch can be estimated for an arbitrary pedal position, as determined by the pedal position sensor **222**. Table-based techniques can also be used for estimating the pitch from the calibration data.

The user interface **306** processes data related to any of the abovementioned modes for output to the electronic display **228**. The data can include a measured pitch, for example, provided by the pitch detector **202**, and/or an estimated pitch, for example, generated by the tuning processor **304**, depending on whether the mode selection module **312** indicates that the system **300** is in a calibration mode or a performance mode. In a calibration mode, the user interface **306** can provide for the display **228** a measured pitch, which can be displayed as the nearest musical note and the deviation. The deviation can be displayed as a numerical value or on a needle dial, or a spinning disk, or related presentation vehicle. In a performance mode, the user interface **306** can provide for the display **228** an estimated timpano pitch corresponding to the instantaneous pedal position. The display **228** will typically show the nearest musical note along with a needle, or some other indication such as a spinning dial, to indicate how sharp or flat the drum pitch is relative to the displayed note. This enables a timpanist to adjust the pedal, or provide a fine tuning adjustment to come very close to the pitch of the desired musical note prior to striking the head. In performance mode, the display **228** can also show the measured pitch from the latest strike of the timpano and can also display the deviation of the measured pitch from the estimated pitch for that pedal position. In performance mode, measured pitch and position data can also be acquired and can be used to update the calibration result.

In an embodiment, the tuning system **300** can be useful for changing the pitch while the kettle drum is still resonating, a technique that is sometimes required. For example, when configured in performance mode, the display of an estimated note will automatically change as the pedal moves to thereby aid the timpanist in correctly modifying the pitch.

The display **328** can display information presented by the user interface **306**, for example, pitch measurement values, calibration results, estimated pitch data, comparison results between measured pitch data and reference pitch data, and/or related information, for example, described herein.

FIG. **7** is a flow diagram of a method **400** for tuning a timpano, in accordance with an embodiment. In describing the method **400**, reference is made to elements of FIGS. **4**-**6**. The method **400** is preferably performed when the tuning system **300** is configured for a calibration mode. The method **400** can equally apply to other percussion instruments known to those of ordinary skill in the art.

At block **402**, the timpano pedal **212** is adjusted to a position corresponding to a lowest pitch of the timpano **200**. This position will be with the pedal **212** at one end of its travel, either all the way up as shown at insert P**1** of FIG. **4** or all the way down as shown at insert P**2** of FIG. **4**. The position of the timpani pedal **212** corresponding to the lowest pitch of the timpani **200** depends on the make, model, or related features of the timpano **200**. The lowest pitch of the timpani **200** can be determined from a set of measured pitches, for example, detected in response to the timpani **200** being struck.

At block **404**, the position of the pedal **212** is measured, more specifically, the position of the pedal **212** corresponding to the lowest pitch of the timpano **200**. This data can be determined by the position sensor **202**. In an embodiment, the determined position data includes the angle of the pedal in degrees or some other unit of angular measurement.

At block **406**, the pitch detector **302** of the control unit **224** is triggered. The pitch detector **302** can be triggered in response to a user applying a force to the head **204**, for example, using a mallet to hit the surface of the head **204**. Here, the pitch detector **302** can detect a timpani pitch, for example, determine a frequency, when the head **104** is at a particular tension corresponding to the location of the pedal. A visual indicator can be activated to provide a visual indication of the triggering of the pitch detector **302**. For example, a light emitting diode (LED) at the control unit **224** can flash or otherwise illuminate. The measured pitch can appear on the display **228**, for example, presented as a value by the user interface **306**. The nearest musical note to the measured frequency can alternatively or in addition be displayed, along with an indication of how sharp or flat it is relative to the nearest note.

At block **408**, data related to the measured pitches and associated pedal positions can be stored in the memory **310**, or another storage location, for example, in a table stored in a database.

At decision diamond **410**, a determination is made whether the pedal **212** is at the opposite end of the adjustment range or if a calibration done input is received from user interface **306**. If the pedal **212** is determined to be at the opposite of the adjustment range or if a calibration done input is received, the method **400** proceeds to block **412**, where the process exits the loop, and a curve-fitting technique or regression technique is applied to the data stored according to block **408**. Embodiments of such techniques are described herein, for example, at FIG. **8**. Otherwise, the method **400** proceeds to block **414**, where the pedal **212** is adjusted in a manner that increases the drum pitch, then to block **404**. The entire calibration method shown in FIG. **7** and described herein, can alternatively commence with the pedal position corresponding to highest timpano pitch and proceed to the pedal position of lowest timpano pitch and provide an equivalent result.

FIG. **8** is a graph **500** of a calibration curve, in accordance with an embodiment. The calibration curve illustrates a plurality of data points **502** taken during a calibration procedure, for example, according to the method **400** described herein, along with a continuous curve **504** that is fitted to the data points **502**. The data points **502** refer to calibration data points taken by the tuning system **300** that determines and stores a frequency and/or note corresponding to a pitch and corresponding pedal position over a range of pedal positions.

The x-axis of the graph corresponds to the position of the pedal **212** as detected by the position sensor **222**, measured in degrees of the angle of the pedal with respect to any arbitrary reference position. The y-axis corresponds to the measured or estimated pitch of the timpano **200**, measured in frequency, or a musical note.

FIG. **9** is a flow diagram of a method **600** for tuning a timpano, in accordance with an embodiment. In describing the method **600**, reference is made to elements of FIGS. **4-8**. The method **600** is preferably performed when the tuning system **300** is configured for a performance mode. The method **600** can equally apply to other percussion instruments known to those of ordinary skill in the art.

At block **602**, a current position of the pedal **212** is measured. The pedal **212** can be positioned anywhere along a path shown in FIG. **4**.

At block **604**, a current pitch is estimated that corresponds to the current pedal position determined at block **602**. The current pitch can be estimated using a fitted curve, for example, the calibration curve **500** shown at FIG. **8** by determining the pitch corresponding to the current pedal position from the calibration curve **500**. Alternatively a table could be used or a mathematical model could be used to estimate the current pitch.

At block **606**, the estimated pitch result is displayed. The estimated pitch result can appear on the display **228**, for example, presented as a value by the user interface **306**. In an embodiment, the value is displayed as the nearest musical note. Alternatively, or in addition, the measured frequency can be displayed. Other related information such as the amount that note is sharp or flat can be displayed

At block **608**, the pedal position is monitored. Here, the sensor **222** attached to the tuning pedal **212** can measure the position, for example, an angle, of the pedal **212**. At decision diamond **610**, a determination is made whether the pedal position has changed. If it is determined that the pedal position has changed, then the method **600** proceeds to block **604**, where a current pitch corresponding to the pedal position is estimated. Otherwise, the method **600** proceeds to block **608**. The display will continue to display the currently estimated pitch until the position changes.

FIG. **10** is a flow diagram of a method **700** for tuning a timpano, in accordance with an embodiment. In describing the method **700**, reference is made to elements of FIGS. **4-6**. The method **700** is preferably performed when the tuning system **300** is configured for an equalization mode, for example, described herein. The method **700** can equally apply to other percussion instruments known to those of ordinary skill in the art.

At block **702**, an equalization mode is activated.

At block **704**, a reference pitch is specified. The reference pitch can be subtracted from subsequent triggered measurements to calculate a frequency difference. The resulting frequency difference can be displayed in Cents, Hz, or related unit of measurement, and/or as a visual indication such as a needle gauge or a spinning disk.

At block **706**, the timpani head **204** is hit at a region near another lug or the like at a different location of the head **204** than the lug of block **702**. The impact is sufficient to trigger the pitch detector **302** of the control unit **224**. The control unit **224** can include an LED or other indicator that can flash or otherwise generate a signal indicating that the timpani head **204** received a force. A pitch or the like is measured in response to the detected force.

At decision diamond **708**, a determination is made whether the measured pitch at the region of the head **204** proximal the other lug at block **706** is within a predetermined acceptable deviation from the reference pitch. The deviation value is determined by calculating a difference between the reference value and the measurement taken at block **706**. If the resulting deviation value is at or less than a predetermined deviation value, for example, then the method **700** proceeds to decision diamond **712**, where a determination is made whether all relevant pitch measurements have been taken. Otherwise, the method **700** proceeds to block **710**, where the lug is adjusted to minimize the deviation from the reference value. Additional measurements can be taken by a user by tapping the region of the head **204** after adjusting the lug and measuring the pitch to determine whether the difference between the reference value and the new measurement value is reduced to fall within an acceptable deviation range.

Returning to decision diamond **712**, if all relevant measurements are taken, then the method **700** proceeds to block **714**, where a determination is made that the tuning process is complete, and more specifically, the pitch deviation at all relevant lugs is at an acceptable value, i.e., at or less than a predetermined threshold. Otherwise, the method **700** proceeds to block **706**, where a pitch measurement or the like is taken at another lug of the timpano.

While the present invention has been shown and described herein with reference to specific embodiments thereof, it should be understood by those skilled in the art that variations, alterations, changes in form and detail, and equivalents may be made or conceived of without departing from the spirit and scope of the invention. Accordingly, the scope of the present invention should be assessed as that of the appended claims and by equivalents thereto.

What is claimed is:

1. A percussion instrument tuning system, comprising:

a position sensor that determines at least one first position of a tuning mechanism of a timpano; and

a control unit that generates a calibration result by measuring a first pitch of the timpano corresponding to the at least one first position of the tuning mechanism, and that estimates a second pitch corresponding to an instantaneous second position of the tuning mechanism from the calibration result and displays the estimated second pitch of the timpano corresponding to at least one second position.

2. The percussion instrument tuning system of claim **1**, wherein the control unit comprises a pitch detector that measures the pitch from the timpano, the calibration result generated from the measured pitch.

3. The percussion instrument tuning system of claim **2**, wherein the pitch detector measures the pitch of a lowest overtone.

4. The percussion instrument tuning system of claim **1**, wherein the control unit comprises a tuning processor that processes the calibration result to determine a value of the estimated second pitch corresponding to the at least one second position of the tuning mechanism of the timpano.

5. The percussion instrument tuning system of claim **1**, wherein the control unit comprises a user interface that provides data for display that is related to at least one of a calibration mode, a performance mode, and an equalization mode.

6. The percussion instrument tuning system of claim **5**, wherein the calibration result is generated in the calibration mode.

7. The percussion instrument tuning system of claim **5**, wherein the estimated second pitch is displayed in the performance mode.

8. The percussion instrument tuning system of claim **5**, wherein a reference pitch is compared to a measured pitch and a difference between the reference pitch and the measured pitch is displayed in the equalization mode.

9. The percussion instrument tuning system of claim **1**, wherein the calibration result determined by the control unit and the tuning mechanism position information determined by the sensor are used to determine an estimated timpano pitch for each of one or more tuning pedal positions.

10. The percussion instrument tuning system of claim **1**, wherein the tuning mechanism includes a pedal, and wherein the position sensor measures an angle of the pedal with respect to a reference position.

11. A method for tuning a timpano, comprising:

determining at least one first pedal position of a timpano;

generating a calibration result by measuring a first pitch of the timpano corresponding to the at least one first position of the tuning mechanism;

estimating a second pitch of the timpano corresponding to at least one second position of the tuning mechanism-from the calibration result; and

displaying the estimated second pitch.

12. The method of claim **11**, wherein generating the calibration result further comprises:

adjusting the tuning mechanism to a position corresponding to a lowest or highest pitch of the timpano;

measuring the position of the tuning mechanism; and

adjusting the tuning mechanism to increase or decrease a pitch of the timpano; and

applying a calibration curve to stored data of the pitch and corresponding position of the tuning mechanism.

13. The method of claim **11**, further comprising measuring a pitch of a lowest overtone.

14. The method of claim **11**, further comprising processing the calibration result to determine a value of the estimated second pitch corresponding to the at least one second position of the tuning mechanism of the timpano.

15. The method of claim **11**, further comprising displaying data that is related to at least one of a calibration mode, a performance mode, and an equalization mode.

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